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ABSTRACT

This paper describes a project that provided television set-top Internet access devices to Latino families as part of a project to link the school and home in an inquiry-based science curriculum. The early phases of adoption of the Internet and the "NetTV" devices by families are described, with special attention to the different ways that families make educational use of the Internet. Internet use data was collected from 13 families of middle school students in Detroit (Michigan). Log files from the "boxes," student interviews, field notes, and parent comments from group meetings provided data that show the emerging patterns of use and preferences for online activity. Children (both students and their siblings) and, to a lesser extent, fathers, were the primary users. Mothers were concerned that their children were using the boxes properly for school, but appear not to have used the boxes much themselves. Education was not the primary application for the boxes, but students did access a wide range of educational resources, including the online science curriculum materials. (Contains 2 figures, 1 table, and 24 references.) (SLD)

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Linking Urban Latino Families to School Using the Web: A Pilot Study

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Linking Urban Latino Families to School Using the Web: A Pilot Study

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Abstract: What happens when a community that has previously had very little or no exposure to the Internet receives Internet access at home? This paper describes a project that provided television set-top Internet access devices to Latino families as part of a project to link the school and home in an inquiry-based science curriculum. The early phases of adoption of the Internet and "NetTV" devices by families are described, with special attention paid to different ways families make educational use of the Internet.

This paper describes results from the early phases of a project that has introduced the Internet to urban Latino families with no previous Internet experience, as part of an effort to link science activities between the home and the classroom. For nearly two decades the Internet, and more recently the World Wide Web, has been touted as a new medium for learning with tremendous potential (Fishman et al., 1997). Researchers have experimented with designs for learning environments using the Internet in both the classroom (e.g., Gomez, Fishman & Pea, 1998; Levin & Cohen, 1985; Levin, 1992; Linn, 1996; Scardamalia et al., 1992) and, to a lesser degree, the home through such mechanisms as "virtual classrooms" and "virtual universities" (e.g., Harasim, 1989; Hiltz, 1989). The current work represents a variation on this genre that has not been widely considered—the use of the Internet in family homes as a bridging mechanism to stimulate engagement in classroom activities.

In the Spring of 1998, researchers from the Center for Highly Interactive Computing in Education (hi-ce) at the University of Michigan[1] provided a group of Latino families with access to the Internet through television set-top boxes (NetTV)[2]. This access was initially provided to help families participate in a science curriculum unit about the physiology of breathing called Learning About Breathing (LAB). In this unit, the Internet was used for collecting and displaying data about lung capacity and environmental factors related to breathing. The entire family is asked to participate in these data collection activities and enter their data from home via the Internet.

A compelling reason for the LAB project to select NetTV as the means for families' Internet access (as opposed to full-fledged computers) is the fact that NetTV uses the family television set as its display, encouraging placement of the NetTV in the household's "public" spaces, such as living rooms or family rooms (though the actual placement of the NetTV devices was a choice made by individual families). We postulated that in order for NetTV to be a viable medium for families to engage in school activity, they must also be encouraged to use it as an extension of their regular recreational or entertainment activities. Uses such as these, that extend far beyond the scope of our curriculum on breathing, may help to increase families' overall comfort level with the tools, thus preparing them to use it more naturally when engaged in curriculum-related activities.

Given the fact that these families are so new to the Internet, and that we have very little *a priori* sense of how they might make use of this technology, our investigation focused on the following questions: How is the Internet appropriated by these families? What kinds of things do they do, given access to email and the World Wide Web? Finally, in what ways do families use NetTV to enhance educational engagement, for either parents or children? These are crucial first questions to

[1] For information about hi-ce, please refer to http://www.hi-ce.org/.

[2] These set-top boxes are commonly called WebTV, which is a trademark of WebTV Networks and used by companies that market devices based on that network's standards. We are using set-top boxes manufactured by uniView, a WebTV competitor, and therefore will refer to these devices using the shorthand "NetTV".

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be answered in our ongoing efforts to establish new opportunities for learning among disadvantaged students and families who have not previously had access to new technologies.

Background and Relevant Literature

Who Uses the Internet?

Mainstream Internet users are white, well-educated, and of higher than average socio-economic status (Hoffman, Kalsbeek & Novak, 1996). Available demographic data on Internet use only recently began reporting on race and ethnicity, and most commonly accepted statistics indicate that only a small percentage of Web users are Latino (e.g., Hoffman, Novak & Venkatesh, 1997). In addition, most data on who uses the Internet indicate a relationship between use and socio-economic status, especially in terms of education. While 76.6% of Latinos with a college education have some access to the Internet (either at home or in the office), that number drops to 16.3% for high school graduates and only 7.1% for those without a high school diploma (Wilhelm, 1998). One place where students from minority or less affluent families *may* be getting access to the Internet is in schools. Roughly three-quarters of all schools in the United States now have some kind of access to the Internet (Bare & Meek, 1998), and according to new studies, white and minority students have roughly equal access to the Internet in schools (Hoffman & Novak, 1998). Thus, while a growing number of students may be getting access to the Internet in schools, their families are not, and there is very little access to and therefore use of the Internet in lower-income Latino homes (National Telecommunications and Information Administration, 1998).

Studies of Home Computer Use for Educational or Academic Purposes

Although personal computers have been in people's homes for two decades, there have been few studies of how computers are adopted and used by families. Three sets of studies have been identified that address issues relevant to the current investigation: When presented with a new, flexible tool like a computer in the home, how do children and adults appropriate it? Who takes ownership of it, and for what uses? What factors seem to be important to the way this appropriation happens?

Venkatesh (1996) conducted a series of studies of computer use at home in the mid and late 1980s. Although in "computer time" this was a long time ago, the studies looked at middle class families during a time when home computing was a brand new idea—an analogous situation to the families in the LAB project who were using the Internet for the first time. Venkatesh found that people perceived computers primarily as tools for job-related tasks, as opposed to recreation or socializing. Home computers were used mostly by males (adult males accounted for 75% of computer use). Families did not consider computers to be "essential" home technologies like the telephone or even the VCR, and they were not certain what the role of the computer should be. Similarly, many families were uncertain of where to locate the computer, debating about whether it should be in the living room, family room, or bedroom (Venkatesh, 1996).

Venkatesh suggests that since the time of his original study, the computer has become a much more accepted, important technology in the home. In order to conceptualize these trends, he proposes a "modified structural-functional approach" (Venkatesh, 1996). This essentially means that the use of technology should be looked at in terms of the social context within which it is embedded, as well as the function that it performs. In other words, to understand why a technological tool is used a certain way, it is not enough to look at an individual interacting with the design and features of the tool; one must take into account the social dynamics that surround the users. This idea is a basic assumption of our investigation of family Internet use in the LAB project.

Another study that did not address the Internet but is relevant for the light it sheds on the educational value of computers in the home was conducted by Giacquinta, Bauer, and Levin (1993). The study is based on data from 70 middle class families who were given computers in

1984-86, a time when personal computers were just beginning to enter the homes of ordinary families. In this work, the authors proposed a model that attempted to include the most important personal and social factors that affect how much home computers are used for academic tasks. Giacquinta et al. (1993) distinguish between "academic computing"—computer use for school-related tasks—and "educational computing," which is computer use that has some apparent educational value, but is not related to schoolwork. Their study focused on "academic computing." The major factors identified were: (1) parental encouragement (2) school emphasis on academic computing (3) peer pressure (4) sibling support (5) presence of appropriate hardware and software at home (6) early positive experiences with academic computing, and (7) a child's initial "receptivity" to academic computing (Giacquinta et al., 1993).

The authors found that there was, in fact, little academic or educational use of computers by the families studied; instead, computers were used mostly for game playing. In explaining this, the authors point to the absence of social support, including parental encouragement, school emphasis on academic computing, peer pressure, and sibling support. Although there was some evidence that parents and teachers valued computer skills in and of themselves, the computer did not fit into the existing social structure of the family or school, except as a toy. The authors call for schools to change their expectations about children's use of computers both at home and at school, and to create home-school relationships that would allow schools to actively support computer-enhanced learning opportunities at home. The LAB project attempted to introduce just this type of change.

The HomeNet Study of Family Internet Use

Perhaps the most extensive set of studies of home computer use is the "HomeNet" studies (Kraut, Scherlis, Mukhopadhyay, Manning & Kiesler, 1996). Forty-eight families, representing a range of demographics and socioeconomic backgrounds, were each given a computer, Internet access, and technical support. Over 55 weeks, researchers collected data in the form of electronic logs of Internet use, bimonthly questionnaires, electronic newsgroup messages, help requests, and home interviews. Though not directly relevant to the current discussion, the reader may recall that this is the same study that produced the now "infamous" findings linking feelings of depression and social isolation to Internet use (Kraut et al., 1998).

Many families in the study were using the Internet for the first time, and despite receiving three-hours of start-up training, over two thirds of the families had difficulty getting started. Not surprisingly, these problems tended to get solved more quickly if more knowledgeable friends or family members could help. In the HomeNet study, teenagers were the heaviest users. The amount of Internet use by the heaviest user in the family predicted the amount of use by other family members, suggesting that an enthusiastic teenager could "pull along" other family members (Kraut et al., 1996).

A surprising finding in the study was that household income and education were not correlated with Internet use, suggesting that if economic barriers to access were removed, socioeconomic differences in Internet access would disappear. On the other hand, race, gender, and generation did have significant correlations with Internet use. Finally, in this study e-mail seemed to be the most important factor in whether people continued to use the Internet. Personal communication, the authors conclude, was more important than the information on the Web in bringing users back again and again.

The Buddy Project

There have been several projects either dedicated to linking home and school over electronic networks or that included that activity as part of a larger enterprise. Examples include the Blacksburg Electronic Village project, which wired schools, homes, and the public library in Blacksburg, VA, and developed an extensive web site for educational, civic, business, and entertainment purposes (Carroll & Rosson, 1996); and the MUSIC project, which involved a handful of residents in a low-income neighborhood in Boston (Shaw, 1996). However, to date only the Buddy Project (North Central Regional Educational Laboratory, 1993) has produced in-

depth research about the impact of computer networks on the academic and family lives of students, and it is the Buddy Project that is most directly relevant to the work conducted in the LAB project.

The Buddy Project was begun in 1989 with five schools in Indiana, and gradually expanded to 20 schools in 1993. The project loaned computers and modems to students and teachers from selected elementary school classes (primarily 4th and 5th grade). Like the HomeNet project, the Buddy Project also provided software, training, and support to participants. Unlike HomeNet, though, and like the LAB project, the Buddy Project explicitly aimed for the computers to be used for school-related academic tasks as well as personal tasks. Also like the LAB project, Buddy project goals included increased parental involvement in their children's schoolwork, though there was no specified curriculum or instructional practices associated with the project. (An important distinction that separates the LAB project from earlier efforts, including the Buddy Project, is that the LAB intervention was associated with a particular set of curriculum and activities as part of a larger systemic reform effort.) In an evaluation report, Buddy stated as one of its goals that, "Parents will become more involved in their children's education through use of computers for homework assignments and through enhanced communications capabilities with schools" (North Central Regional Educational Laboratory, 1993).

Evidence from case studies about the Buddy Project (McMahon, 1993; McMahon & Duffy, 1993) indicates that for a few families the computers were catalysts for increased parental involvement in students' homework. However, in general parents did not gain a great deal of computer skills or use computers to communicate with teachers (McMahon, 1993; North Central Regional Educational Laboratory, 1993). These findings echo those of the HomeNet study, indicating that parents often lag behind their children in adoption of home computing technology. There is evidence, however, that parents in Buddy Project families tended to communicate more with teachers and other parents—but not on-line (McMahon, 1993). The computers served as a subject of, rather than a means for, communication.

Another finding from the Buddy Project that is relevant to the present study was that, despite increased student motivation for computer-based work, overall homework return rates were lower for Buddy students (83% vs. 94%), and lower within classes when homework was required to be done on the computer. The authors of the 1993 report speculated that this might be due to computer homework being more difficult overall, the fact that it could not be done during school free time, and technical problems with the computers. As we will discuss below, on-line homework completion rates were also low in the LAB project, though a rigorous comparison with non-computer homework assignments was not undertaken.

Methods

Study Setting and Subjects

The project described in this paper was conducted in the Spring term of the 1997-98 school year, at a middle school in Detroit with a population roughly 60% African American and 40% Latino. Participants were the families of students enrolled in "ESL II Science," a course designed for Spanish speakers with some proficiency in English, but not enough for regular English-language science classes. Many of the students' families were seasonal workers, and the class size varied between 18 and 24 students. The class was officially at the seventh grade level, but students were placed in this class by language ability rather than age, and the class included students as young as 11 and as old as 14. During class time, the teacher spoke primarily in English, though he allowed the students to respond in Spanish. The majority of the students in the class were from Mexico, with some from Puerto Rico. Most of the students had moved to the United States with their families within the past several years, and the parents, for the most part, spoke only Spanish.

This was not the first time these students and their teacher had worked with our research group. The ESL II Science classroom as well as that of three other teachers in the school have been

enacting science curricula designed by the hi-ce research group for the past year and a half. This was, however, our first interaction with any parents in this school.

In December and January, the family of each student in the ESL II Science class was offered a NetTV set-top Internet box and a subscription to dial-up Internet services at no charge. A total of twenty families received set-top boxes. Some students did not have telephone service in their homes, and therefore did not receive a NetTV box; for those students, several NetTV boxes were made available in the during class time and after school "tutoring time" on Tuesdays and Thursdays. Two students in the class were brother and sister, and shared a single NetTV box at home. Families who received the NetTV boxes were visited by groups of Spanish-speaking graduate students from the University of Michigan who helped them to set-up the NetTV boxes and gave them an initial tour of its features. These same students kept in contact with families, both in person and over the phone, to support their use of the devices and to aid in troubleshooting. One member of our research team carried a pager so that families could reach him if they were having technical trouble, and he was paged frequently in the early stages of the project. The actual curriculum associated with the use of the NetTV boxes was started in late February, and ran until the end of the school year, with four one-week breaks due to vacations and standardized testing.

Data Sources and Instruments

There were four data sources for this research: log files from the NetTV boxes, student interviews, field notes from the classroom and family visits, and records of group parent meetings. All families participating in this study signed research consent forms (translated into Spanish) indicating that they were aware that their NetTV use would be tracked using log files collected centrally by the manufacturer of the NetTV devices, and made available to us for interpretation. Due to timing issues (some students joined the program late in the semester), not all families received the NetTV boxes at the same time, and therefore we have valid data from only 13 of the NetTV boxes. These logs were valuable primarily for indicating when families used their NetTV boxes. Because the logs are collected from a central proxy server not controlled by the research team, it was not possible to use them to indicate particular web sites that families may or may not have visited. The student interviews were designed to provide information about the types of web sites visited, and the purposes for visiting them. We interviewed a total of fourteen of the students in the class[3]. Detailed field notes were kept by researchers who visited and called family members, and they provided qualitative data on how the NetTV boxes were being used by families and what kinds of questions people had about using them. Field notes were also taken during classroom observations, but these notes were designed to track the evolving design of the breathing curriculum more than the impact of the Internet on student learning. The final data source is notes taken at two group meetings with parents held in the latter half of the project. These meetings were designed in response to the initially low use of the NetTV boxes for completing classroom homework assignments, in order to solicit feedback on the design of the activity and to understand how family participation in these homework activities might be improved. These meetings were essentially focus groups, allowing us to probe parent attitudes and opinions on both the educational value they perceived for the Internet, as well as the role it might play in their household.

[3] Our intent was to interview all students in the class, but we unable to due to time and access limitations.

Findings

Although we have learned a great deal about how the families in the LAB project appropriated the Internet, we must emphasize the exploratory nature of this study. It is important not to over-generalize these findings from our population of twenty Latino families to the broader Latino-American population. Other complicating factors for these findings include the fact that many families had a shaky start-up period with NetTV box software that was not completely stable, necessitating a lot of initial troubleshooting. Nonetheless, we have informative data to report on what families did with the Internet, how they appropriated the Internet into their households, and how they used the Internet for educational activities.

Trends in NetTV Use by Families

An examination of log data from the NetTV boxes during the period from January 1, 1998, to May 8, 1998 reveals patterns of NetTV use that are sensible in light of our larger, qualitative view of family activity. Use was highest on weekends, but there was fairly consistent use of NetTV by families across days of the week (see Figure 1).

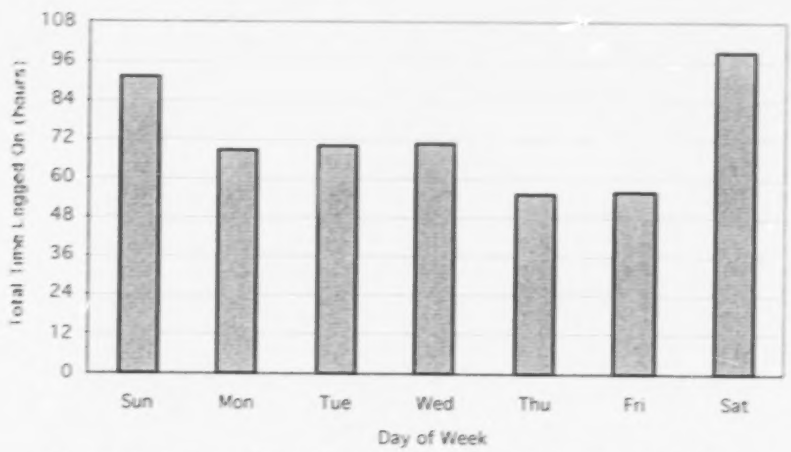

Figure 1: Amount of NetTV use (in hours) by all families by day of week.

During the week, nearly half of all NetTV use occurred in the after school and early evening hours, from 2pm to 8pm. The next most common log-on time was actually during the school day, from 8am to 2pm, accounting for just under a quarter of use. Although the school day was usually 8:05 to 2:15, several school week-long vacations and early dismissal days occurred during the project, which would account for use during this time period. On weekends, the majority of use occurred early in the day. A slight surprise was that nighttime log-ons (after 8pm) accounted for less than 10 percent of use both on weeknights and on weekends (see Figure 2).

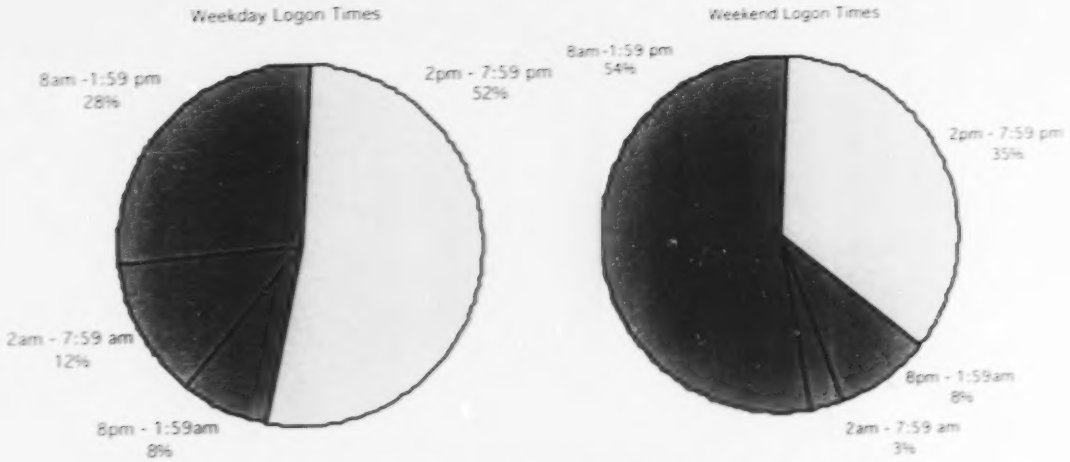

Figure 2: Times of weekday (left) and weekend (right) log-ons to NetTV.

The total amount that families used their NetTV boxes ranged from approximately 16 hours during the 128 days between January 1st and May 8th, to nearly 107 hours, though this was in a family (referred to below as "Family M") that had two students enrolled in the ESL II Science class [Table 1]. The majority of families logged between 20 and 50 hours of NetTV usage during the study period. Two families used NetTV on only 13 days, and Family M used it on 71 days. On days when NetTV was used, relatively long sessions were common—most families logged on for 30 minutes or more on at least half the days they used NetTV. Use of e-mail was generally low—only family "M" accessed e-mail more than 11 times, and seven families accessed e-mail less than 6 times. However, our qualitative observations indicate that several students checked email more regularly using the NetTV boxes we had set up in their classroom.

Table 1: NetTV use by 13 families, Jan 1st to May 8th, 1998.

Family	Total time logged on (hour: min)	Total number of Web actions*	Days with at least one log-on	Days with over 30min log-on time	Number of log-ons with email activity
A	16:02	273	22	10	9
B	16:40	510	13	10	4
C	16:45	264	21	10	5
D	22:52	660	46	16	2
E	23:46	370	20	10	3
F	29:14	860	13	11	10
G	31:48	1028	26	17	10
H	35:32	507	33	13	1
I	40:40	697	25	17	1
J	47:00	1031	30	20	3
K	59:28	2742	23	18	9
L	66:31	2328	36	27	11
M**	106:59	1887	71	36	79

Notes: *Total commands to web browser, including "back" and clicks on hyperlinks. **Family M had two students enrolled in the project class.

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Appropriation of NetTV by Participating Families

The prevailing attitudes of parents towards NetTV were a mix of anticipation and anxiety. The installation of the NetTV boxes was an "event" that most family members attended. People were excited at the prospect of making up their own usernames and email addresses. At one of the group meetings with parents, a father expressed gratitude that the university had provided computers for the homes, because "everything now is based on computers," and he went on to express this is a great opportunity for his community to get familiar with computers. Another parent said that computers help parents to get involved with their children's activities, and there was general agreement that having access to computer and network resources from home was an advantage to their children, even if it was not a quantifiable advantage.

Several parents expressed apprehension about the NetTV box. This generally seemed to be not a fear of technology *per se*, but concern that they would be financially responsible if something happened to their NetTV box. One mother, for example, first said she didn't want a unit because her family wouldn't be able to pay for it if they broke it. Despite assurances that they would not be held accountable, some parents remained nervous about "borrowing" the NetTV.

Much of the NetTV use was by students alone, with siblings, or with friends, and to a lesser degree with parents. Some parents seemed to view NetTV as part of their children's world, and approximately half of the NetTV boxes were installed in the student's bedroom rather than a living or family room. An extreme example involved a student who used NetTV in her bedroom. When, in the middle of the semester, the family's TV broke down, her TV was moved to the living room, but the NetTV box was not re-connected there. Instead, she had to arrange to borrow another TV before she could use NetTV again.

On the other hand, some parents showed significant involvement. Two students indicated that their fathers like to use the NetTV box to read newspapers, in particular papers from their home regions in Mexico. In conversations with a group of parents at one of the parent meetings, three of them indicated interest in using the NetTV to find information about events "back home." Parents already had access to Spanish-language media through cable television (the only way to have access to Spanish-language television in the city, so all families in this study were cable subscribers despite its cost), but several turned to NetTV in search of more detailed news, and met with limited success. While the majority of students did their on-line science assignments alone or with peers, several students reported involving their parents in their homework assignments (as was intended in the curriculum design of the breathing project). Recreational uses of NetTV—for example, looking up recreational information about sports, television, and movies— tended to center around the students and their siblings. However, one student reported surfing the web for fun with his brothers and father, and another was more specific about looking for information about cars and auto shows with his father. Although mothers were very active in the parent planning meetings, and were more vocal than the fathers about the value of the NetTV boxes to their children, they do not appear to have been active users of the NetTV boxes in the home.

Educational Uses of NetTV

While most parents expressed considerable concern with their children's academic success in general, factors such as difficult work schedules, the unfamiliar form and content of their children's schoolwork, and the level of their own linguistic and academic skills made it difficult for some parents to participate actively in their children's studies. Educational use of NetTV should be seen in this context. In our group meetings and in visits to homes, many parents showed interest in finding out how the NetTV boxes could support their children's learning. When setting up the NetTV in one home, one mother asked us to show her where her son "had to go" on-line to do his homework. Two other parents at one of the group meetings evaluated the on-line homework positively, stating that it was "less boring" than the usual homework their children bring home, and that doing homework together with their children provided a useful means for them to get to know about technology as a family.

Students were slightly less enthusiastic about NetTV as an educational tool. In interviews, 9 students indicated that doing homework on-line was "OK," and 3 students stated that they "love" doing homework on-line (out of a total of 14 students interviewed). However, only 8 indicated that they would be more likely to do their homework on- as opposed to off-line. Students explained that this was because they were afraid of losing their homework in a crash, though one student indicated that it was an advantage to have his homework on NetTV, because he could get access to it from anywhere and didn't have to worry about losing a piece of paper.

Although the predominant use of the NetTV technology was for recreational activity, there is evidence to suggest that it was used to support a broad range of educational activities. These include the homework that was assigned as part of science class, but more importantly, use went beyond those assignments to include other kinds of homework-related and educational activity. Most parents' comments about the purpose of NetTV characterized it as for their children's learning. This is not surprising, as the boxes arrived at their homes as part of a school-sponsored activity. Students in the project definitely saw the primary purpose of the NetTV box as for homework, or at least called attention to that fact when convenient—in a home where younger siblings expressed great interest in using the NetTV box to our visiting researcher, the student asserted loudly that she had first priority in using the box because it was intended for *her* to do *her* homework. During a visit to another family, a girl was upset because she was having trouble getting on-line and was afraid this would cause her to get a bad grade in the class.

Students found NetTV useful for homework beyond ESL II Science. In several visits, students told us that they used the NetTV boxes to do homework for other classes. In interviews, three students indicated that they used the NetTV box as part of their English and Reading classes, and one student reported that they had used it to do homework for social studies class. One girl reported "getting a URL from someone in school" to find a page that helps solve mathematics problems. Others tried to use the NetTV box to support homework—for example, looking up vocabulary words like "symbiosis"—but had trouble finding the information they needed. Other families also had trouble with Internet searching, which is a problem not limited to the NetTV technology but characteristic of Internet use in general (Wallace & Kupperman, 1997).

Conclusion

The families that participated in this study are by no means proficient in the use of the Internet, but neither should we expect them to be after just five months. On the other hand, patterns of use and preferences for on-line activity are starting to emerge. Children (both students and their siblings), and to a lesser extent, fathers, were primary users of the uniView boxes. Mothers were very concerned that their children were making proper use of the boxes for school, but appear not to have used the boxes much themselves. Although education was not the predominant application for the NetTV boxes, students did access a broad range of educational resources using NetTV. This included using our own on-line curriculum materials, but also some self-directed web use in support of homework in other classes.

In addition to observations about the progress families made in coming to use the Internet, we have also learned a great deal about how to foster use among these "atypical" Internet users. In-home technical support, especially in the first several weeks and months of home use, was critical. The group meetings we held for parents were also important in giving people a chance to see how others were using their NetTV boxes, and to learn what was possible.

As a group, Latinos in the U.S. currently have less access to the Internet than other minorities, and far less access than the majority white population. Devices such as NetTV present an opportunity for new segments of the population to become involved in the on-line world, and linkages to schools are logical means for fostering family involvement. Our experiences in this one small community are an important first step to understanding the challenges that new classes of Internet users will face, and provides insight into how to turn these challenges into opportunities.

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